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# BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

MAILED

NOV 04 2004

GROUP 2800

Application Number: 09/733,289
Filing Date: December 08, 2000
Appellant(s): MU ET AL.

XIAO-CHUN MU ET AL.
Schwegman, Lundberg, Woessner & Kluth, P.A.
For Appellant

## EXAMINER'S ANSWER

This is in response to the appeal brief filed 6/28/04.

***(1) Real Party in Interest***

A statement identifying the real party in interest is contained in the brief.

***(2) Related Appeals and Interferences***

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

***(3) Status of Claims***

The statement of the status of the claims contained in the brief is correct.

***(4) Status of Amendments After Final***

No amendment after final has been filed.

***(5) Summary of Invention***

The summary of invention contained in the brief is correct.

***(6) Issues***

The appellant's statement of the issues in the brief is substantially correct. The changes are as follows:

(1) Whether claim 1 is unpatentable under 35 U.S.C. 103(a) over Chen et al. (U.S. Pat. 6,160,311) in view of Jimarez et al. (U.S. Pat. 6,407,334).

(2) Whether claim 29 is unpatentable under 35 U.S.C. 103 (a) over Chen et al. (U.S. Pat. 6,160,311) in view of Jimarez et al. (U.S. Pat. 6,407,334) and further in view of Woodward et al. (U.S. Pat. 4,731,700).

(3) Whether claims 1-4 are unpatentable under 35 U.S.C. 103(a) over Eichelberger (U.S. Pat. 5,250,843) in view of Jimarez et al. (U.S. Pat. 6,407,334).

(4) Whether claim 29 is unpatentable under 35 U.S.C. 103(a) over Eichelberger (U.S. Pat. 5,250,843) in view of Jimarez et al. (U.S. Pat. 6,407,334) and further in view of Woodward et al. (U.S. Pat. 4,731,700).

(5) Whether claims 10 and 15-16 are unpatentable under 35 U.S.C. 103(a) over Shen (U.S. Pat. 6,368,894) in view of Woodward et al. (U.S. Pat. 4,731,700).

(6) Whether claims 11-14 are unpatentable under 35 U.S.C. 103(a) over Shen (U.S. Pat. 6,368,894) in view of Woodward et al. (U.S. Pat. 4,731,700) and further in view of Eichelberger (U.S. Pat. 5,250,843).

(7) Whether claim 17 is unpatentable under 35 U.S.C. 103(a) over Shen (U.S. Pat. 6,368,894) in view of Woodward et al. (U.S. Pat. 4,731,700) and further in view of Jimarez et al. (U.S. Pat. 6,407,334).

***(7) Grouping of Claims***

Appellant's brief includes a statement that: claims 1-4 and 29 stand or fall together; claims 10-17 stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

***(8) Claims Appealed***

The copy of the appealed claims contained in the Appendix to the brief is correct.

***(9) Prior Art of Record***

| | | |
|---|---|---|
| 6,160,311 | Chen et al. | 12-2000 |
| 6,407,334 | Jimarez et al. | 6-2002 |

| | | |
|---|---|---|
| 4,731,700 | Woodward et al. | 3-1988 |
| 5,250,843 | Eichelberger | 1-1993 |
| 6,368,894 | Shen | 4-2002 |

***(10) Grounds of Rejection***

The following ground(s) of rejection are applicable to the appealed claims:

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Pat. 6160311) in view of Jimarez et al. (U.S. Pat. 6407334).

Chen et al. disclose a semiconductor device (cover fig.) comprising:

a heat sink 32 (column 3, lines 30-31);

at least one microelectronic die 31 having an active surface and a back surface, wherein at least one microelectronic die back surface adjacent to the heat sink;

a patterned adhesive layer 33 disposed between the die 31 and the heat sink 32; and

an encapsulation material 36 (column 3, lines 58-59) disposed on the heat sink and the microelectronic die active surface.

Chen et al. fail to disclose the patterned adhesive layer 33 is a patterned thermally conductive adhesive.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Chen et al. to increase the heat dissipation between the die and the heat sink, as shown by Jimarez et al.

3. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Pat. 6160311) in view of Jimarez et al. (U.S. Pat. 6407334) and further in view of Woodward et al. (U.S. Pat. 4731700).

Chen et al. and Jimarez et al. fail to disclose a microelectronic package core and wherein at least one die is disposed within at least one package core opening.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising:

a ceramic member 14 having a first surface and an opposing second surface, the ceramic member having at least one opening defined therein extending from the ceramic member first surface to the ceramic member second surface, where the ceramic member second surface abuts the heat sink 12; and

wherein at least one die 16 is disposed within the ceramic member opening and adjacent the heat sink, the die having an active surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Chen et al. and Jimarez et al. to provide an electrical crossover in

the area above the die and increase in interconnect density, as shown by Woodward et al.

4. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger (U.S. Pat. 5250843) in view of Jimarez et al. (U.S. Pat. 6407334).

Eichelberger discloses a semiconductor device (fig. 1, column 13, lines 51 et seq.) comprising:

a heat sink 12 ;

at least one microelectronic die 14 having an active surface and a back surface, wherein at least one microelectronic die back surface adjacent to the heat sink;

a thin die attach material 16 disposed between the die and the heat sink (column 13, lines 64-66); and

an encapsulation material 18 disposed on the heat sink and the die active surface.

Eichelberger fails to disclose a thin die attach material 16 is a patterned thermally conductive adhesive layer.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Eichelberger to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

- Regarding claim 2, Eichelberger discloses a build up layer disposed on an upper surface of the encapsulant material.

- Regarding claim 3, Eichelberger discloses the build up layer comprises at least on conductive trace 20 disposed on the encapsulation material upper surface, wherein a portion of the conductive trace extending through the encapsualation material to contact the microelectronic die active surface.
- Regarding claim 4, Eichelberger discloses the build up layer further includes at least one dielectric layer 24 disposed on at least a portion of the encapsulation material upper surface and at least on conductive trace, and at least one second conductive trace 26 extending through the dielectric layer to contact the conductive trace.

5. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger (U.S. Pat. 5250843) in view of Jimarez et al. (U.S. Pat. 6407334) and further in view of Woodward et al. (U.S. Pat. 4731700).

Eichelberger and Jimarez et al. fail to disclose a microelectronic package core and wherein at least one die is disposed within at least one package core opening.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising:

a ceramic member 14 having a first surface and an opposing second surface, the ceramic member having at least one opening defined therein extending from the ceramic member first surface to the ceramic member second surface, where the ceramic member second surface abuts the heat sink 12; and

wherein at least one die 16 is disposed within the ceramic member opening and adjacent the heat sink, the die having an active surface. Therefore, it would have been

obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Eichelberger and Jimarez et al. to provide an electrical crossover in the area above the die and increase in interconnect density, as shown by Woodward et al.

6. Claims 10 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. (U.S. Pat. 4731700).

Shen discloses a semiconductor device (figs. 1-2, column 4, lines 5 et seq.) comprising:

a heat sink 33 (column 5, lines 27);

a package core 1 having a first surface 10 and an opposing second surface 14, the package core having at least one opening 11 (fig. 2) defined therein extending from the package core first surface to the package core second surface;

at least one die 3 (column 5, lines 30) disposed within at least one package core opening and adjacent the heat sink, at least one die having an active surface; and

an encapsulation material 34 disposed on the die and in portions of at least one package core opening.

Shen fails to disclose where the microelectronic package core second surface abuts the heat sink.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising: a ceramic member 14 having a first surface and an opposing second surface, wherein the ceramic member second surface abuts a heat sink 12. Therefore, it would have been obvious to one having ordinary skill in the art at the time the

invention was made to modify the device of Shen to provide good heat dissipation for the semiconductor package device, as shown by Woodward et al.

- Regarding claim 15, Woodward et al. disclose a thickness of the ceramic member 14 is greater than a thickness of at least one die 16.
- Regarding claim 16, Shen discloses the package core is a material selected from the group consisting of ceramics or metals (column 4, lines 5-10).

7. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. and further in view of Eichelberger (U.S. Pat. 5250843).

Shen and Woodward et al. fail to disclose a build up layer disposed on an upper surface of the encapsulation material.

Eichelberger discloses a semiconductor device (fig. 1, column 13, lines 51 et seq.) comprising: a build up layer disposed on an upper surface of the encapsulation material 18 to provide interconnection pads (column 10, lines 54-57). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen and Woodward et al. to provide a direct interconnection between integrated circuit chips, as shown by Eichelberger.

- Regarding claim 12, Eichelberger discloses the build up layer comprises at least on conductive trace 20 disposed on the encapsulation material upper surface, wherein a portion of the conductive trace extending through the encapsualation material to contact the microelectronic die active surface.

- Regarding claim 13, Eichelberger discloses the build up layer further includes at least one dielectric layer 24 disposed on at least a portion of the encapsulation material upper surface and at least on conductive trace, and at least one second conductive trace 26 extending through the dielectric layer to contact the conductive trace.
- Regarding claim 14, Shen discloses the encapsulation (34 and 24) covers the package core first surface.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. and further in view of Jimarez et al. (U.S. Pat. 6407334).

Shen and Woodward et al. fail to disclose a patterned thermally conductive adhesive layer.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen to increase the heat dissipation between the die and the heat sink, as shown by Jimarez et al.

***(11) Response to Argument***

- In response to Appellant's argument that there is no motivation to combine the references, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all

of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

- The Appellant argues that "there is no teaching or suggestion in Chen to look to Jimarez to find a patterned adhesive 44 in Jimarez."

The Appellant's arguments have been fully considered but they are not persuasive because Chen et al. disclose a patterned adhesive layer 33 disposed between the die 31 and the heat sink 32 (cover fig., column 3, lines 36-40). Chen et al. do not specifically point out that the adhesive layer 33 is a patterned thermally conductive adhesive, but Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art to select the patterned thermally conductive adhesive layer, as taught by Jimarez et al. into the device structure of Chen et al. to increase the heat dissipation between the die and the heat sink. Moreover, selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co., Inc. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

- The Appellant argues that "Jimarez fails to teach an encapsulation material that is disposed on the die active surface and the heat sink, as required in claim 1."

The Appellant's arguments have been fully considered but they are not persuasive because this argument has no immediate apparent relevance to the issues

presented by the rejection before us since an appellant can not show nonobviousness by attacking references individually wherein the rejection is based upon a combination of references. *In re Young*, 403 F. 2d 754, 757, 159 USPQ 725, 728 (CCPA 1968).

It should be noted that the rejection of claim 1 is not based on anticipation, but rather, is based on obviousness.

Examiner relies on the combined teachings at Chen et al. and Jimarez et al. Jimarez et al. is not relied on for teaching the encapsulation material that is disposed on the die active surface and the heat sink. Jimarez et al. is relied on for showing the patterned thermally conductive adhesive layer. The Examiner thus regards the Appellant's assertions as constituting evidence that the Appellant has failed to consider as a whole the prior art teachings disclosed by the combination of the references.

- In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case: Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention

was made to modify the device of Chen et al. to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

- The Appellant argues that Woodward's chip 16 and heat sink 12 is a layer of molybdenum 12c that is not taught as an adhesive of any type. Rather, item 12c is simply referred to as a part of the heat sink 12.

The Appellant's arguments have been fully considered but they are not persuasive because Woodward's layer 12c0 is an adhesive layer because the bottom surface of chip 160 is soldered to 12c0 (column 5, lines 35-36). The layer 12c0 is between the chip and the heat sink.

- In response to Appellant's argument that there are different technical challenges, such as there is no expectation of success to get a better pin-out or better ground the die and it is not obvious to combine the references, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).
- In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the

references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case:

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising:

a ceramic member 14 having a first surface and an opposing second surface, the ceramic member having at least one opening defined therein extending from the ceramic member first surface to the ceramic member second surface, where the ceramic member second surface abuts the heat sink 12; and

wherein at least one die 16 is disposed within the ceramic member opening and adjacent the heat sink, the die having an active surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Chen et al. and Jimarez et al. to provide an electrical crossover in the area above the die and increase in interconnect density, as shown by Woodward et al.

- The Appellant argues that Eichelberger's thin die attach material 16 is not patterned.

The examiner respectfully disagrees.

Eichelbeger's thin die attach material 16 is patterned because it is made, adapted or fashioned according to the form or model described in the specification (column 14, line 50-55).

- The Appellant argues that Eichelberger's encapsulant 18 is not disposed on the

substrate 12, rather, it is disposed on the die attach material 16.

The Appellant's arguments have been fully considered but they are not persuasive because the die attach material 16 is disposed on the substrate 12; the encapsulant 18 is disposed on the die attach material 16; therefore, the encapsulant 18 is disposed on the substrate 12 (cover fig.).

- In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case: Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Eichelberger to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

- The Appellant argues that Eichelberger in view of Jimares does not teach the limitation of claim 1, "an encapsulation material disposed on said heat sink and said microelectronic die active surface" (claim 1).

The examiner respectfully disagrees because Eichelberger discloses an encapsulation material 18 disposed on said heat sink 12 and said microelectronic die active surface (fig. 1).

- The Appellant argues that the application of Woodward to Shen destroys and renders impossible the structures taught by Shen.

The Appellant's arguments have been fully considered but they are not persuasive because in this case:

Shen fails to disclose wherein the microelectronic package core (1) second surface abuts the heat sink.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising: a ceramic member 14 having a first surface and an opposing second surface, wherein the ceramic member second surface abuts a heat sink 12.

- The Appellant argues that there is no location for Eichelberger's structures 18, 20, 24 and 26; the combination of Eichelberger with Shen and Woodward does not amount to the limitations of claims 11, 12, 13 or 14 and destroys and renders impossible the structures taught by Shen.

The Appellant's arguments have been fully considered but they are not persuasive because one of ordinary skill would have readily modified the structure of Shen by replacing the mounting chip 2 with Eichelberger's structures 18, 20, 24 and 26. Therefore, the combination of Shen with Eichelberger renders obvious the limitations of claims 11-14.

Eichelberger discloses a semiconductor device (fig. 1, column 13, lines 51 et seq.) comprising: a build up layer disposed on an upper surface of the encapsulation material 18 to provide interconnection pads (column 10, lines 54-57). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen and Woodward et al. to provide a direct interconnection between integrated circuit chips, as shown by Eichelberger.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

DiLinh Nguyen
October 20, 2004

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